

## ABSTRACT

A novel process for the direct oxidation of hydrogen and hydrocarbons is disclosed, where the explosion risks inherent in gas phase oxidations are substantially eliminated. Gaseous oxidation reactants are soluble in a first reaction solvent phase such as a perfluorocarbon (e.g.  $C_8F_{18}$ ) and the oxidation product is preferentially soluble in a second product solvent phase such as water or a dilute acid. A solid catalyst such as palladium on alumina is then contacted with the dissolved reactants. The oxidation product such as hydrogen peroxide may be separated from the reaction solvent phase by extraction into the immiscible product solvent phase and then separated from it by distillation, thereby allowing re-use of the aqueous phase. The present invention may be carried out using a two-phase reaction system whereby both the reaction solvent and product solvent are contained within a reaction vessel into which the solid catalyst is slurried and mechanically agitated to promote the reaction.